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Reactor for execution catalytic gas reactions with a pressure resistant jacket and ever a ball soil at the front outer periphery

The invention relates to a reactor for execution catalytic gas reactions with a pressure resistant jacket and per a ball soil at the front outer periphery, whereby at least in the range of the jacket a catalyst bed is arranged, over whose height a plurality of cold gas supply provided flowing into the catalyst bed it is.

From the DE-AS 15 42 209 a such reactor is known, with which over the height of the cylindrical shell arranged cold gas supply exist out transverse to the direction of flow of the reaction gas arranged, mixing area formed cages with perforated walls, which preferably exhibit arranged tubes for the feed line of the Kaltgases in their interior, whereby for making the entry of a substantial portion of the reaction gas possible into the cages these corresponding large designed are. By the size of these cages a relative large space requirement for the cold gas supply installations becomes required, so that the space standing for the catalyst for the order and thus the reaction space are unnecessary limited. So a relative satisfactory recording of temperature in the reactor achieved can become, the performance of the reactor is however by the limited reaction space standing for the order not satisfactory.

In contrast to this the object of the invention exists in the provision of a solution, with which the reaction space of a such reactor filled with catalyst can become enlarged, whereby also in the auxiliary area as uniform a temperature distribution as possible should be more adjustable.

This object becomes according to invention with a reactor of the initially referred type by the fact dissolved that in the range of the ball soils one catalyst bed each with cold gas supply is arranged, whereby the cold gas supply are formed as vertical arranged nozzle tubes with essentially horizontal feed lines.

By the additional arrangement of catalyst beds in the range of the ball soils a substantial magnification of the reaction area becomes possible, whereby possible by the formation of cold gas supply also in the range of the ball soils a very uniform temperature distribution is also in this range. The use of cold gas supply in the range of the ball soils, which exhibit only a limited interior, is only by according to invention, very space saving embodiment the possible. Known cold gas supply as in the DE-AS 15 42 209 are not bring inable due to their large space requirement in conventional ball soils. By the formation of nozzle tubes a very fine cold gas distribution becomes achieved, whereby a particularly good mixture with the hot reaction gases and thus an uniform temperature distribution adjust themselves.

It is particularly convenient, if the nozzle tubes are in the upper ball soil directed and the nozzle tubes downward upward in the lower ball soil directed at the respective feed lines arranged. By this arrangement the space standing in the respective ball soil for the order can become optimum utilized, i.e. despite only small the interior in the range of the ball soils, standing for the order, a sufficient amount at Kaltgas can become fine partitioned to the respective catalyst bed and thus to the hot reaction gas discharged.

Constructive particularly simple and space saving plans the invention that the feed lines are as to both pages of a central tube with central arranged, the ball soil coat penetrating cold gas supply pipe arranged distribution pipes formed. The cold gas supply become preferably so installed that the distribution pipes are for instance in the transition region between the cylindrical reactor coat and the respective ball soil arranged. This compact embodiment is suitable in particular also for the Nachrüstung of reactors.

Provided is particularly favourable that the outer edge-lateral nozzle tubes are short formed as the inner nozzle tubes. By this formation adapted to the hemisphere-wall-flat of the respective ball soil the ball soil area can become still better utilized.

It is convenient, if the distribution pipes are in a distance making a catalyst flow possible arranged at the central tube next to each other. The catalyst can then with the filling and/or. Deflation free by the space between the distribution pipes flow through.

Finally the invention also still plans that the nozzle tubes of a perforated jacket are surrounded, which prefered from expanded metal formed is. By this jacket on the one hand clogging of the nozzle openings of the nozzle tubes becomes avoided by catalyst, on the other hand one is ensured that the effluent Kaltgas can occur unhindered the catalyst bed.

The invention is appended for example more near explained on the basis the drawing. This shows in:

Fig. 1 in strong simplified representation a section by formed a according to invention reactor,
Fig. 2 a cross section by the reactor in the range of the ball soils,
Fig. 3 an enlarged represented nozzle tube in an elevation view and
Fig. 4 a section in accordance with the line IV - IV in Fig. 3.

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A general with 1 referred reactor is in particular natural to the methanol synthesis with high printing and temperatures between 200 and 300 DEG C suitable, can this reactor in addition, for other exothermic or also endothermic catalytic gas reactions used become.

The reactor 1 is in the drawing only shown with for the invention the essential features. The reactor exhibits a cylindrical shell 2, an upper ball soil 3 with gas inlet connecting pieces 4 and a lower ball soil 5 with gas outlet nozzle 6. In the range of the cylindrical shell 2 a catalyst bed is 7 arranged, whereby over the height of the catalyst bed 7 a plurality of cold gas supply provided flowing into the catalyst bed is, which are in the drawing not more near shown and do not arrive closer on it here also.

In the range of the upper ball soil 3 as well as in the range of the lower ball soil 5 in each case an additional Kata is lysatorbett 7a, 7b with cold gas supply 8a, 8b provided. The additional catalyst beds 7a, 7b are selbstvertändlich in the drawing as single beds shown, can the catalyst beds in addition, direct with the catalyst bed 7 connected be, i.e. as common, the entire reactor 1 essentially filling out catalyst bed formed its.

The cold gas supply 8a, 8b are of vertical arranged nozzle tubes 9a, 9b with essentially horizontal feed lines 10a, 10b formed. The nozzle tubes 9a in the upper ball soil 3 are vertical upward directed thereby and the nozzle tubes 9b in the lower ball soil 5 vertical downward directed, whereby prefered are the outer edge-lateral nozzle tubes short formed in each case, i.e. to the curved wall surface of the ball soils adapted are, so that an optimum space utilization is possible.

Like particularly good from Fig. 2 comes out, consist the feed lines 10a of a central tube 11a also to both pages of the same next to each other arranged distribution pipes 12a, at which the nozzle tubes are 9a arranged. The central tube 11a is central with a cold gas supply pipe 13a connected, which penetrates the jacket of the upper ball soil 3 and exhibits at the free end a cold gas pipe union 14a. The feed lines 10b in the range of the lower ball soil 5 are corresponding formed, whereby in the Fig. 1 the same numerals with the addition "b" used are.

As from Fig. 2, are the single distribution pipes in such a manner next to each other arranged come out that the light distance between the single distribution pipes is sufficient large, in order to make a catalyst flow possible with the filling or deflation. It turned out that lights a distance of approximately 80 mm of particularly favorable is, whereby this distance depends naturally also on the particle size of the catalyst.

From the Fig. 3 and 4 the structure of a nozzle tube is to be recognized, whereby only a nozzle tube is 9a shown, the nozzle tubes 9b within the lower ball soil range is corresponding designed. Each nozzle tube 9a exhibits a disk shaped cover 15a, whose outside diameter is larger as the outside diameters of the nozzle tube 9a formed at the free end, so that a support surface is 16a for a perforated jacket 17a formed. This jacket is prefered formed from expanded metal. and the coated outer region of the nozzle tube 9a, in which a variety of nozzle openings 18a formed are. By the jacket avoided becomes that the nozzle openings 18a with catalyst add themselves and can to amplifier open.

As from Fig. 1 comes out, is the cold gas supply 8a, 8b in such a manner in the reactor 1 arranged that the feed lines 10a, 10b are in the transition region of the cylindrical shell 2 to the ball soils 3, 5. With the filling of the reactor 1 with catalyst become first the cylindrical portion 2 the range of the upper ball soil 3 subsequent with the lower ball soil 5 filled and, whereby the balance of later catalyst contractions the upper ball soil 3 becomes first high filled, when in the drawing shown is.

The reaction gases will flow by the gas inlet connecting piece 4 into the reactor 1 introduced and downward, first by the upper catalyst bed 7a essentially vertical from above, the catalyst bed 7 and finally by the lower catalyst bed 7b, in order to leave the reactor by gas outlet nozzle the 6. A temperature rise in the catalyst bed 7a, 7, 7b with the expiration of the reaction will by the introduction of Kaltgas avoided, whereby in the cylindrical portion 7 in known manner cold gas supply are provided, naturally can also the cold gas supply 8a, 8b corresponding cold gas supply used become. In the upper ball soil 3 the Kaltgas becomes by the cold gas pipe union 16a introduced and flows by the cold gas supply pipe 13a into the central tube 11a and from there over the single distribution pipes 12a into the nozzle tubes 9a.Durch the nozzle openings 18a occurs itself the Kaltgas of fine partitioned vertical for the mainstream direction of the hot reaction gas into the catalyst bed 7a and mixed with the reaction gas, so that an uniform temperature distribution adjusts itself in the catalyst bed 7a. Uniform withdrawing of the Kaltgases by the nozzle openings 18a becomes ensured by the fact that the Kaltgas with a corresponding high pressure becomes into the cold gas supply pipe 13a introduced. The cold gas supply in the lower ball soil 5 made analogous.

Natural one is not the invention on the embodiments limited represented in the drawing. Other aspects of the invention are possible, without leaving the principle. So an additional catalyst bed 7a provided can be, like also only in the lower ball soil 5 and such in certain cases of application also only in the upper ball soil 3. more.

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1. Reactor for execution catalytic gas reactions with a pressure resistant jacket and per a ball soil at the front outer periphery, whereby at least in the range of the jacket a catalyst bed is arranged, over whose height a plurality of cold gas supply provided flowing into the catalyst bed is,
thus characterized,
that in the range of the ball soils (3,5) one catalyst bed each (7a, 7b) with cold gas supply (8a, 8b) is arranged, whereby the cold gas supply (8a, 8b) are formed as vertical arranged nozzle tubes (9a, 9b) with essentially horizontal feed lines (10a, 10b).

2. Reactor according to claim 1,
thus characterized,
that the nozzle tubes (9a) are in the upper ball soil (3) directed and the nozzle tubes (9b) downward upward in the lower ball soil (5) directed at the respective feed lines (10a, 10b) arranged:

3.Reaktor according to claim 1 or 2,
thus characterized,
that the feed lines (10a, 10b) are as to both pages of a central tube (11a, 11b) with central arranged, the ball soil coat (3,5) penetrating cold gas supply pipe (13a, 13b) arranged distribution pipes (12a, 12b) formed.

4. Reactor after Anspurch 1 or one the subsequent,
thus characterized,
that the outer edge-lateral nozzle tubes (9a, 9b) are short formed as the inner nozzle tubes (9a, 9b).

5. Reactor according to claim 1 or one the subsequent,
thus characterized,
that the distribution pipes (12a, 12b) are in a distance making a catalyst flow possible arranged at the central tube (11a, 11b) next to each other.

6. Reactor according to claim 1 or one the subsequent,
thus characterized,
that the nozzle tubes (9a, 9b) of a perforated jacket (17a) are surrounded.

7. Reactor according to claim 6,
thus characterized,
that the jacket (17a, 17b) from expanded metal is formed.

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